REMARKS/ARGUMENTS

1. Rejection of claims 1-19:

Claims 1-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. (U.S. Patent 6,929,998). Reasons of rejection are cited on pages 2-14 of the above-mentioned Office action.

Response:

Examiner notes that Chen et al. discloses a method for forming bottle-shaped trench. According to Chen's disclosure, a plurality of trench is formed in the substrate 100, and only one trench 104 is shown in Fig. 1a. Next in Fig. 1b, a recess 105 is formed when the pad oxide layer 101 is etched by buffer hydrofluoric acid. Next, ***silicon oxide layer 106*** *is filled into the recess to protect the pad oxide layer 101 in the subsequent etching.* Thereafter, an ASG layer 108 is formed overlaying the masking layer 103 and the inner surface of the trench 104. Referring to Fig. 1c, *a conductive layer is formed* on the ASG layer 108 *and fills the trench 104*. Subsequently a CMP process and an etching back process are performed to leave a portion of conductive layer 110 and the ASG layer 108' in the trench 104. As shown in Fig. 1d, the doped layer 108' is removed to leave a portion of doped layer 108" surrounding the conductive layer 110 in the lower portion of the trench 104. Next, *a silicon nitride layer 112 is deposited* overlaying the upper portion of the inner surface of the trench 104 *to cover the conductive layer 110 and the ASG layer 118". **Next, a heat treatment is performed** on the substrate, thereby diffusing the dopant in to the adjacent substrate 100 to form a doping region 111.* It should be noticed that the heat treatment is performed while the conductive layer 110 remains in the trench 104. Next, the silicon nitride layer 112 is removed to form a collar silicon nitride layer 112'. As shown in Fig. 1g, *the conductive layer 110 and **the ASG layer 108" are successively removed*** to expose the surface of the doping region 111. Hence, the conductive layer 110 of Chen's invention may function as a sacrificial layer. After that, an oxidation is

performed to formed a doped oxide region 111'. Hereinafter, in Fig. 1g, the doped oxide region 111' is removed to form a bottle-shaped trench 113 having a greater diameter at the lower portion. Afterward, *the color silicon nitride layer 112' is removed in Fig. 1i.*

To emphasize the differences between the present application and Chen's invention, applicant amends the original claim 1, and the amended claim 1 is repeated in the following for illustration.

1. (Currently amended) A method for forming a deep trench capacitor buried plate comprising:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing a dry etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

etching back the sacrificial layer for exposing parts of the doped silicate glass film;

removing the exposed doped silicate glass film;

removing the remaining sacrificial layer;

depositing a silicon nitride layer on the inner wall of the deep trench;

performing a thermal process for forming a doped region at a bottom of the trench **after the remaining sacrificial layer is removed**;

removing the silicon nitride layer; and

removing the doped silicate glass film;

wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

According to Fig.6 and paragraph [0017], the present application uses a sacrificial layer to define the collar region 60 and the ASG film (the silicate glass film) 58 at the bottom of the deep trench 56. **After that, the sacrificial layer is removed** and a silicon

nitride layer 64 is deposited on the inner wall of the deep trench 56 and fills up the recess 62 as well. As shown in Fig. 7, **a thermal process is performed without having the sacrificial layer disposed in the deep trench 56.** (*Chen et al. perform the thermal process while the conductive layer 110 is positioned in the trench 104*). In addition, **the silicon nitride layer 64 overlays the whole inside wall of the deep trench 56** and acts as a barrier layer for preventing ions of the ASG film 58 from diffusing into the collar region 60 of the deep trench 56. Afterward, the silicon nitride layer 64 is removed, and then, the ASG film 58 is removed subsequently. (*Chen et al. remove the ASG layer 108' (shown in Fig. 1g) before the silicon nitride layer 112 is removed (shown in Fig. 1i)).* Therefore, the amended claim should be distinguishable from Chen's invention. Reconsideration of amended claim 1 is politely requested.

Applicant also amends the original claim 7; the amended claim 7 is repeated as following for illustration.

7. (Currently amended) A method for forming a deep trench capacitor buried plate comprising:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing a dry etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

removing a portion of the sacrificial layer for exposing parts of the doped silicate glass film;

performing an etching process to remove the exposed doped silicate glass film and a portion of the pad oxide layer for forming a recess;

removing the remaining sacrificial layer;

depositing a silicon nitride layer on the inner wall of the deep trench **and filling up**

the recess with the silicon nitride layer;

performing a diffusing process for forming a doped region at a bottom of the trench;

removing the silicon nitride layer; and

removing the doped silicate glass film;

wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

As discussed in the prior paragraph, **the ASG film of the present invention is deposited** on the inner wall of the deep trench 56. Then, a etching process is performing to remove the ASG film to form the collar region 60 in the inner wall of the trench 54, the ASG film 58 disposed at the bottom of the inner wall of the deep trench 54, and the recess 62 at the same process. After that, **the silicon nitride layer 64** is deposed on the inner wall of the deep trench 54 and **fills the recess 62**. Consequently, *the steps of Chen's invention forming the ASG film 108' at the bottom of the inner wall of the deep trench 104* ***before*** *the recess 105 is formed.* In addition, *Chen et al. fills the recess 105 by silicon oxide 106.* Therefore, the amended claim 7 should be patentable over Chen's invention. Reconsideration of amended claim 7 is respectfully requested.

Applicant further amends the original claim 13; the amended claim 13 is repeated in the following for illustration.

13. (Currently amended) A method for forming a deep trench capacitor buried plate comprising:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing an etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

etching back the sacrificial layer for exposing parts of the doped silicate glass film;

removing the exposed doped silicate glass film and forming a collar region in the inner wall of the deep trench;

removing the remaining sacrificial layer;

depositing a silicon nitride layer **on the surface of the collar region** in the inner wall of the deep trench **and on the surface of the remaining silicate glass film after removing the remaining sacrificial layer;**

performing a thermal process for forming a doped region at a bottom of the trench;

removing the silicon nitride layer; and

removing the doped silicate glass film.

Herein, the present invention forms the silicon nitride layer 64 on the surface of the collar region 60 and the surface of the ASG film 58 **after the sacrificial layer is completely removed.** However, *the silicon nitride layer 112 is deposed on the surface of the conductive layer 110 and on the inner wall of the trench* ***while the conductive layer 110*** *(acting as the sacrificial layer of the present invention)* ***exists in the trench 104.*** Accordingly, the amended claim 13 should be distinguished from Chen's invention. Reconsideration of amended claim 13 is sincerely requested.

Claims 2-6 are dependent upon the amended claim 1, and claims 8-12 are dependent upon the amended claim 7. Furthermore, claims 14-19 are dependent upon the amended claim 13. Therefore, claims 2-6, 8-12, and 14-19 should be allowable if claims 1, 7, and 13 are found allowable. Reconsideration of claims 1-19 is respectfully requested.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Sincerely yours,

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